

CLAIMS

1. An internal combustion engine in which gas from an auxiliary source is introduced to assist, enhance or substitute for the products of combustion normally used to power the engine.
2. An engine, as in claim 1, in which gases produced in the cylinder at high pressure during the ignition phase are bled into an auxiliary reservoir and are reintroduced into the cylinder at a lower pressure and at a later point in the power stroke.
3. An engine, as in claim 1, in which gas from a separate source is stored in a reserve reservoir at pressures above those in the primary reservoir and the engine cylinder, to inject into the primary reservoir or directly into the cylinder, on demand.
4. An engine, as in claim 2, in which any cylinders of a multi-cylinder engine serve a single primary reservoir from which any designated cylinders can draw high pressure injection gas for operation.
5. An engine, as in claim 2, in which a reserve reservoir is preheated by an external source or a heat exchanger to increase its injection pressure and thereby improve performance.
6. An engine, as in claim 2, in which any cylinders of a multi-cylinder engine can operate on the Otto or Diesel cycle and the remaining cylinders can operate with auxiliary gas injection at any load percentage desired by the operator.
7. An engine, as in claim 2, in which one or more cylinders operate in a lean-fuel or no-fuel condition, primarily for the purpose of maintaining the primary reservoir in a fully charged condition.
8. An engine, as in claim 2, in which the operation of exhaust and intake valves, fuel input and injected gas input are under computer control so that the optimum time and amount of gas injection can be attained.

9. An engine, as in claim 3, in which all or a portion of the gas stored in the reserve reservoir undergoes a solid, liquid, or gaseous phase change.
10. An engine, as in claim 3, in which the gas stored in the reserve reservoir is air, steam, sulfur dioxide, carbon dioxide, products of combustion, or mixtures thereof.
11. An engine, as in claim 3, in which the gas stored in the reserve reservoir contains combustible components.
12. An engine, as in claim 3, in which one or more cylinders are designed for a higher compression ratio so as to supply the gas stored in the primary and reserve reservoirs.
13. An engine, as in claim 2, in which the primary reservoir is of sufficient size to support engine operation without a reserve reservoir.
14. An engine, as in claim 2, in which the primary reservoir is omitted and the reserve reservoir injects gas directly into the cylinder.
15. An engine, as in claim 2, in which both the primary and reserve reservoirs operate at a pressure at or below the peak pressure attained in the cylinder so that gas is injected into the cylinder later in the power stroke and at a reduced pressure.
16. An engine, as in claim 2, in which an excess of fuel is introduced into the cylinder, said excess being combusted by high pressure air or oxygen injected into the cylinder from the primary or reserve reservoirs on the power stroke.
17. An engine, as in claim 2, in which either the primary or reserve reservoir serves to inject gas directly into the cylinder during the power stroke to provide an easy-start feature.
18. An engine, as in claim 2, in which fuel is supplied to selected cylinders with the remaining cylinders operating to pump gas into the primary or reserve reservoirs.